



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
[www.uspto.gov](http://www.uspto.gov)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/718,744	11/21/2003	Rajaram Bhat	SP03-165	1828
22928	7590	06/09/2005	EXAMINER	
CORNING INCORPORATED SP-TI-3-1 CORNING, NY 14831			TUROCY, DAVID P	
			ART UNIT	PAPER NUMBER
			1762	

DATE MAILED: 06/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/718,744

Applicant(s)

BHAT, RAJARAM

Examiner

David Turocy

Art Unit

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |  |
|---|--|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. ____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>5/2/05, 11/21/03</u> . | 6) <input type="checkbox"/> Other: ____  |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 112***

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-20 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a group II element containing compound where the Group III element *is* covalently bonded with nitrogen, does not reasonably provide enablement for flowing vapors of a group III element containing compound wherein *at least one* Group III element is covalently bonded to nitrogen. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims. The specification is enabled for a group III metal containing compound where the Group III element *is* covalently bonded with nitrogen, i.e. GaN, InN, and AlN. However, the specification does not reasonably enable one of ordinary skill in the art to use a vapor of a Group III metal containing compound wherein two or more Group III elements are covalently bonded to nitrogen without undue experimentation. In this instance the undue experimentation includes determining what compounds contain two or more metals selected from the group consisting of In, Ga, and Al, where one of the metals is covalently bonded to nitrogen as well as determining which species of the excessively large genus will be effective in the coating process as claimed.

3. Claims 11-14 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specification is silent to examples of Group III containing element compound with two or more metals selected from the group consisting of In, Ga, and Al, where one of the metals is covalently bonded to nitrogen. One of ordinary skill in the art at the time of the invention would not be able to provide vapors having two or more metals selected from the group consisting of In, Ga, and Al without undue experimentation. In this instance the undue experimentation includes determining what compounds contain two or more metals selected from the group consisting of In, Ga, and Al, where one of the metals is covalently bonded to nitrogen as well as determining which species of the excessively large genus will be effective in the coating process as claimed.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 18 and 20 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Art Unit: 1762

- a. Claim 18: The examiner cannot determine the metes and bounds of a ratio of less than 15% to 85%. How can a ratio be less than 15% and up to 85%. For the purposes of applying art the examiner is interpreting the ratio to be 15% to 85%.
- b. Claim 20, last limitation: The wording of the last limitation, starting "flowing vapors of nitrogen" is awkward and unclear. The examiner cannot determine whether the listing of nitrogen compounds are utilized during both the growth phase and the cooling phase. For the purposes of applying art the claim is interpreted to read on supplying a nitrogen of the compound listing during both the growth phase and the cooling phase.

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 1-4, 9, and 17-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 03/041137 by Kang et al, hereafter Kang in view of US Patent 4713354 by Egawa et al., hereafter Egawa.

Kang teaches of a method of forming a dilute nitride film comprising the steps of placing a III-V substrate, i.e. GaAs, in the reaction chamber, flowing vapors of at least one group III organometallic compound, i.e. trimethyl indium and trimethyl gallium, in the presence of a group V compound, AsH<sub>3</sub> and flowing vapors of a group III element containing compound where the Group III element is covalently bonded to nitrogen, i.e. H<sub>2</sub>GaN<sub>3</sub> or Cl<sub>2</sub>GaN<sub>2</sub> (Page 1, line 23, Page 3, line 14- Page 4, line 23). Kang discloses the reactor temperature is about 700°C (Page 4, line 16).

Claim 2 and 3: Kang discloses the reaction apparatus includes MOCVD or MBE (Page 4, lines 1-3).

Claim 4: Kang discloses a GaAs substrate (Page 1, line 23).

Claim 9: Kang discloses flowing vapors of a gallium-containing compound where the gallium is covalently bonded to nitrogen, i.e. H<sub>2</sub>GaN<sub>3</sub> or Cl<sub>2</sub>GaN<sub>2</sub> (Page 3, lines 228-30).

Kang fails to disclose heating the substrate in an atmosphere including a first group V element matching the group V element of the III-V substrate. However, Egawa, teaching of a method heating a III-V compound substrate, discloses heating in a gas atmosphere of which the gas includes an element constituting the III-V compound substrate to reduce the dislocation density near the surface of the substrate (abstract).

Art Unit: 1762

In particular, Egawa discloses heating a GaAs substrate in an atmosphere that includes AsH<sub>3</sub>, as the group V element as well as hydrogen and argon, known carrier gases (Column 3, line 25, Column 4, line 55). Egawa also discloses heating the substrate of other III-V compound substrates using a gas atmosphere including an element constituting the III-V compound substrate (Column 4, lines 61-66).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kang to heat the III-V substrate in a atmosphere that includes the group V compound of the substrate and carrier gases as suggested by Egawa to provide a desirable heating of the substrate because Egawa discloses heating a group III-V substrate in a atmosphere containing the group V compound of the substrate and known carrier gases is known in the art to prevent dislocation density near the substrate surface and therefore one of ordinary skill in the art would be motivated to reap the benefits of being able to heat the substrate without dislocation density near the substrate surface.

Claim 17: Kang in view of Egawa teaches of the same first and second group V element.

Claim 18: Kang in view of Egawa fails to disclose providing the group III element covalently bonded to N and the group III element organometallic compound in the ratios as claimed.

However, Kang disclose the content of the nitrogen in the dilute nitride film can be simply and easily adjusted under the control of the inflow of the metal organic compound. Therefore Kang establishes the amount of the group III element covalently bonded to N as a cause effective variable. It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980).

8. Claims 5-7 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kang in view of Egawa as applied to claim 1 above and further in view of US Patent Publication 2002/0124965 by Shibata et al., hereafter Shibata.

Claims 5-7: Kang in view of Egawa teaches all the limitations of these claims as discussed above in the 35 USC 103(a) rejection, however, they fail to disclose providing a GaP, InAs, or an InP substrate.

However, Shibata discloses depositing nitride films on various substrates by MOCVD including group III-V single crystal substrates and uses GaAs and InP as examples of such III-V substrates, but it is the examiners position that the disclosure of Shibata is not limited to such examples and therefore additionally encompasses GaP and InAs substrates as claimed (Paragraph 0020). Therefore Shibata discloses other group III-V substrates, including InP, GaP and InAs are equivalents of GaAs when



Art Unit: 1762

depositing nitride films. Substitution of equivalents requires no express motivation. *In re Fount*, 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152, USPQ (CCPA 1967).

Claim 16: Kang in view of Egawa teaches all the limitations of these claims as discussed above in the 35 USC 103(a) rejection, however, they fail to disclose flowing the organometallic compound into the reaction chamber in the presence of a second group V element gas different from the first group V element gas.

However, Shibata, teaching depositing nitride films on various substrates by MOCVD, discloses supplying the organometallic component into the reaction chamber using a carrier gas comprising nitrogen, a group V compound different from the first group V compound utilized during the heating of the substrate (Paragraph 0007).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kang in view of Egawa to use the nitrogen carrier gas as suggested by Shibata because Shibata discloses a nitrogen carrier gas is known in the art to supplying organometallic compounds to a MOCVD chamber and therefore would reasonably be expected to effectively provide organometallic compounds during the process of Kang in view of Egawa.

9. Claims 8 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kang in view of Egawa as applied to claim 1 above and further in view of US Patent 5209952 by Erdmann et al, hereafter Erdmann.

Kang in view of Egawa teaches all the limitations of these claims as discussed above in the 35 USC 103(a) rejection, however, they fail to disclose flowing vapors containing Indium or Aluminum covalently bonded to nitrogen during the deposition phase.

However, Erdmann, teaching of a method for MOCVD deposition of an III-V nitride film, discloses using a chemical compound of aluminum, gallium or indium covalently bonded to nitrogen, which has a vapor pressure suitable for vapor deposition (Column 2, lines 4-35). Erdmann discloses the chemical composition of the deposited film determines the properties of the film (Column 1, lines 17-20). Therefore Erdmann discloses indium and aluminum is a substitute for gallium in a compound for vapor phase formation of nitride films.

Therefore, it would have been obvious to one skilled in the art at the time of the invention to modify Kang in view of Egawa to use aluminum or indium in place of gallium, depending on the nitride films desired properties, as suggested by Erdmann because Kang in view of Egawa teaches using gallium covalently bonded to nitrogen to form a nitride film and Erdmann teaches aluminum and indium are known in the art as substitutes for gallium during the formation of nitride film

10. Claims 15 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kang in view of Egawa as applied to claim 1 above and further in view of US Patent 5926726 by Bour et al, hereafter Bour.

Kang in view of Egawa teaches all the limitations of these claims as discussed above in the 35 USC 103(a) rejection, however, they fail to disclose cooling down the substrate in the presence of a group V vapor or gas for preventing decomposition of the nitride film and flowing vapors of nitrogen during the growth step and cooling down step.

However, Bour, teaching of a method for growing a III-V nitride film in a MOCVD reaction chamber, includes providing a cooling down step after the formation of the nitride film and discloses flowing a preventor gas, i.e. ammonia, into the reaction chamber to prevent nitrogen outdiffusion from the grown layer (abstract, Column 6, lines 30-37). Bour also discloses using a preventor gas that breaks up into N and H molecules or another non-reactive molecule, such as dimethylhydrazine and would encompass the others gases as claimed (Column 8, lines 5-10). Bour also discloses flowing gases of ammonia is common during the growth phase (Column 5, lines 40-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kang in view of Egawa to use the cool down including nitrogen compound containing gas as suggested by Bour to provide a desirable nitride film on a III-V substrate because Bour discloses cooling down in a nitrogen atmosphere is known in the art to prevent diffusion of nitrogen from the gown nitride film and therefore would reasonably be expected to effectively provide a dilute nitride film on a III-V substrate.

Art Unit: 1762


***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to David Turocy whose telephone number is (571) 272-2940. The examiner can normally be reached on Monday-Friday 8:30-6:00, No 2nd Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

David Turocy  
AU 1762



**TIMOTHY MEEKS  
SUPERVISORY PATENT EXAMINER**